Vegetation Survey of Cook's Bridge Area Fisher's Valley, St Helena Island



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1. Introduction and Terms of Reference

Fisher's Valley is a wetland area of great national and international importance. It is not only the largest freshwater wetland area on St Helena, but in thousands of square kilometres of the South-Atlantic Ocean. It can be seen as a wet oasis flowing through the dry deserts of Prosperous Bay Plain. It is one of the main habitats for the moorhen (*Gallinula chloropus*) native to St Helena and also the islands' last endemic land bird, the wirebird (*Charadrius sanctaehelenae*) uses the area as feeding grounds (Ashmoles 2000). The importance of freshwater wetlands for the biodiversity on St Helena, especially invertebrates, is currently not well understood. This vegetation survey has been undertaken to support and inform future management and restoration activities in the area, and to mitigate the disturbance that building a new culvert at Cook's Bridge has caused (for more information please see section 6).

Fisher's Valley is situated in Longwood, the north western side of St Helena. The stream in the valley runs all the way from the Central Peaks to Prosperous Bay, at wet times being the longest watercourse on the island. The upper parts of the stream have permanent water flow but the middle and lower sections can dry out in dry summer months (Ashmoles 2000). As the largest freshwater wetland site on St Helena, Fisher's Valley has been proposed as a site for the international Ramsar convention for the protection of wetlands (code UK52003, Pienkowski 2005, JNCC 2006). Parts of Fisher's Valley are also included in the National Conservation Area (NCA) of Prosperous Bay Plain and the Important Wirebird Area (IWA) of Upper Prosperous Bay Plain.

This survey is part of the Landscape and Ecological Mitigation Programme (LEMP) for the St Helena airport development. The intention of the survey is to record the current state of the wetland vegetation in the section of the valley closest to Cook's Bridge and to give recommendations for the management of the area and mitigation of the airport development, namely the new Cook's Bridge (for more information on this please see section 6). The survey also gives baseline information of the vegetation that can be used in invertebrate surveys.



Map 1 - Situation of the survey area in the northern section of St Helena.

2. Survey Area

The survey area extends on both sides of Cook's Bridge, including a piece of pastureland and wild mango thicket on the upstream side and continuing until the first waterfall downstream. The area chosen gives the opportunity to study how vegetation in grazed and un-grazed wetland areas differ from each other. The main interest in this survey was on the wetland vegetation. However there were some findings of endemic plants outside the actual survey area, on the dry sides of the valley and also lower downstream the valley. These are included in the survey results.

The downstream part of the survey area is part of the Prosperous Bay Plain Nature Reserve (NR). The upper stream part was originally part of the Upper Prosperous Bay Plain Important Wirebird Area (IWA). Part of the upstream area was taken out from the IWA as it came part of the Airport Development Area (ADA) due to the former plans to extract water from Fisher's Valley for the Airport development purposes. Water extraction never took place but the area still remains as part of the ADA. Whether this and other similar largely un-impacted areas will go back to being part of the National Conservation Areas (NCA) needs to be clarified.



Map 2 - Survey area in Fisher's Valley in relation to Cook's Bridge and Bradley's Garage



Map 3 - Survey area in relation to the Airport Development Area (ADA) and National Conservation Areas (NCA).

3. Methodology

The methodology for the survey was based on the Joint Nature Conservation Committee's (JNCC) *National Vegetation Classification* (Rodwell 2006) and the adaptation of the previous method used in the *Dry Gut and Southern Ridge of Prosperous Bay Plain – Habitat Survey Report* (Cairns-Wicks & Lambdon 2012). This methodology was chosen in the hope that most of the future vegetation surveys would follow the same principles and the results would be comparable with each other.

Survey site boundaries were delimited by using a satellite image from 2009. The same satellite image and a walkover on 16th October 2014 were used to define draft homogenous vegetation areas inside the survey site. Two further field visits were made on 21st and 22nd October to study the finer scale vegetation areas and the species composition of the vegetation in more detail. Sample areas were chosen for each different vegetation type in places that were subjectively chosen as representative for the whole homogenous vegetation area. A sample size of 10 m² was chosen on the basis that the vegetation types in question were all either species poor herbaceous vegetation or species poor scrubland vegetation (see Rodwell 2006 for more detail on the methodology). The layout of the survey plots in relation to different vegetation types can be found in *Appendix 1*. The Domin scale was used to define the abundance of each species in the sample areas. Additionally level 11 was used for species that were found in the homogenous vegetation area but were not present in the 10 m² sample areas. GPS coordinates (WGS84, UTM UPS) were taken from each of the sample sites. Maps were produced using open source GIS program QGIS.

Table 1. Domin Scale:

Cover	Domin
(Outside sample plot)	(11)
91-100%	10
76-90%	9
51-75%	8
34-50%	7
26-33%	6
11-25%	5
4-10%	4
<4% (many individuals)	3
<4% (several individuals)	2
<4% (few individuals)	1

4. Results

Full records of all the species and abundances in the sample plots can be found in *Appendix 1*. Overall the plant communities in the study area were very species poor with a few introduced invasive species dominating most of the vegetation, namely wild mango, thatching grass, bamboo grass and kikuyu grass (see *Appendix 1* for more details and scientific names).

Species considered native or probably native were sparse, proliferous spike-rush (probably native) and thatching rush (probably native) being the only species that were found from more than one place. Cape beard grass (probably native) and bayonet grass (native) were found in one small area right next to a small waterfall where they grew together with proliferous spike-rush and thatching rush. Possibly native field sedge was found in several sites, mainly in wet grazed areas, openings in wild mango thicket and muddy open vegetation.

Populations of endemic tufted sedge and boneseed were found on the dry hillside next to the survey area. These are included in the survey report for their importance although they aren't part of the wetland vegetation and didn't grow inside the study area. The most interesting finding was the sighting of a small population (12 plants) of endemic St Helena tea plant further down in the Lower Fisher's Valley downstream from the first high waterfall.



Map 4 - Homogenous vegetation areas and other findings in the survey

4.1 Riparian Schinus scrub (Lambdon & Darlow 2008), or wild mango thicket

Wild mango thicket seems to be the climax vegetation type in the survey area, being able to outcompete both grazed and un-grazed grassy vegetation. Very little other vegetation survives under the thick wild mango canopy, mainly weedy species like fleabane, blueweed and diddly dight in small openings of areas that are not under grazing. Mat grass was found thriving under rather thick wild mango canopy in one un-grazed site. In grazed areas very little vegetation was growing under wild mangoes. Most interesting finding was proliferous spike-rush (probably native) growing under some wet areas on the edges of thick wild mango canopy. This species was found both in grazed and un-grazed areas.

4.2 Thatching grass sward (including bamboo grass)

Thatching grass is dominating the vegetation almost everywhere in the survey area where wild mango hasn't outcompeted it or grazing isn't keeping it in bay. In some, especially wet, areas bamboo grass replaces thatching grass. Bamboo grass seems to tolerate grazing better than thatching grass. Both of these grasses form monocultures excluding practically all lower vegetation.

4.3 Wet muddy area with tallow vine

In one site of the survey area a very wet and open muddy flat with tallow vine and some field sedge (possibly native) was found. An endemic wirebird was also seen feeding on the site.

4.4 Vegetation on the grazed land

In grazed open areas a clear zonation in the vegetation can be seen in relation to the gradient in moisture. Dry parts of the pasture are covered with sparse salt bush. In moister areas kikuyu grass provides thick cover practically outcompeting most other species. In some wet areas bamboo grass dominates with some proliferous spike-rush (probably native) and field sedge (possibly native) growing in between. Proliferous spike-rush seems to grow most widely in those wet areas that are at the edge of thick wild mango canopy.

4.5 Waterfall

The most diverse patch of wetland vegetation was found at the downstream extreme of the survey area, just before the stream runs over a small waterfall. Species in this area include native bayonet grass and the probable natives thatching rush, Cape beard grass and proliferous spike-rush. Some wild celery (naturalised) is also growing in the area. This small patch of vegetation seems to be connected to the vegetation type found on wet cliff sides lower down in the valley, dominated by species like thatching rush, celery and Cape beard grass.

4.6 Disturbed area next to the new Cook's Bridge culvert

The construction site of the new Cook's Bridge culvert was practically devoid of vegetation at the time of the survey. Interestingly few annual beard-grasses (probably native) were found in a newly opened ditch just upstream from the disturbed area. These will most probably set seed and the species establish in the disturbed wet areas close by. Endemic wirebirds have been seen feeding on the open muddy wet areas.

5. Conclusions and discussion

The conservation status of Fisher's Valley on the upstream side of Cook's Bridge needs to be clarified. This area was cut out from the Upper Prosperous Bay Plain Important Wirebird Area (IWA) when it became part of the Airport Development Area (ADA). The inclusion of this area in the ADA was due to the former plans to extract water from Fisher's Valley for the Airport development purposes. As the water extraction never took place this area is largely un-impacted by the airport development and the conservation values are still present. For this reason the area should be included in the Upper Prosperous Bay Plain Important Wirebird Area (IWA) once again. Similar issues in former National Conservation Areas (NCA) need to be clarified in several other sites as well, not only in Fisher's Valley.

What comes to plant biodiversity, the survey area is poor and practically completely dominated by introduced invasive species. Wild mango creates the climax vegetation outcompeting most other vegetation both in grazed and un-grazed situations. In open un-grazed areas large grasses, namely thatching grass and bamboo grass, dominate the vegetation forming complete monocultures. In grazed open areas vegetation is a little bit more diverse but largely dominated by kikuyu grass. Left unmanaged the future of the survey site and the whole of Fisher's Valley is very likely to be thick wild mango thicket similar to the one already covering the bottom of Shark's Valley in Levelwood.

The most diverse patch of wetland vegetation was found at the eastern extreme of the survey area just before the stream runs over a small waterfall. There a small patch of three probably native species, namely thatching rush, proliferous spike-rush and Cape beard grass were found growing together with the native bayonet grass. The reason for the more diverse vegetation in this small site might be because the pressure of flowing water, especially at flood times, is too high for the establishment of dominating thatching grass sward. This small patch is in connection with wider areas of similar vegetation lower down in the valley on wet cliff sides next to a high waterfall. It seems that inaccessible cliffs next to waterfalls might be very good places to be looking at when trying to figure out how the original wetland vegetation on St Helena might have looked like. In these areas the vegetation has been protected from the effects of goats and to some extent also the invasive vegetation.

Grazing clearly has an effect on the vegetation. In the grazed areas upstream from Cook's Bridge the thatching grass seems to be kept at bay by the cattle thus giving space for species that are able to form shorter sward, mainly kikuyu grass but also proliferous spike-rush in wet and semi shaded places. Short grass in wet areas provides feeding ground for the endemic wirebird. The native moorhen can probably utilise open short kikuyu grass pastures, thick thatching grass thickets and possibly even wild mango thicket, but the habitat preferences of this bird species needs to be studied in more detail.

6. Suggestions for habitat management

Activities in the construction footprint, namely the disturbed area on both sides of Cook's Bridge, would be the responsibility of the contractor (Basil Read). Activities outside of the construction footprint would be the responsibility of "others", namely the St Helena Government. All activities mentioned in map 5, except from the "future planting" would be part of the Landscape and Ecological Mitigation Program (LEMP) for the Airport development. "Future planting" area is a suggestion of an area that could be reforested in future according to the experiences gained in the plot "Experimental planting". It is suggested that monitoring of the areas



Map 5 - Suggestions for the management of the habitats

6.1 Landscape values

To open a view into the pastoral landscape in Fisher's Valley it is suggested to clear all the wild mango from the upstream side of Cook's Bridge and to fence the area as cattle pasture. Clearance of the trees should be done in stages to make sure that grassy vegetation has sufficient time to establish before the grazing starts and also to make sure that the change to the stream habitat happens in stages.

Detailed landscaping with endemic and native plant species is suggested to be directed to disturbed areas adjacent to Cook's Bridge, however keeping in mind not to close the view to the pasturelands upstream. Planting is suggested to be divided into wetland planting in the main water channel, experimental riparian planting on the sides of the channel and dryland planting on the dry banks.

Experiments in turning wild mango thicket and thatching grass sward into endemic riparian forest is suggested to take place in the areas downstream from Cook's Bridge. This would be of scenic interest to people traveling over the bridge from the airport to other parts of the island.

6.2 Biodiversity values

There is a need for more information on the invertebrate fauna in the wetland habitats of Fisher's Valley to direct the management practices. It would be beneficial to know what kind of effect grazing has on the endemic invertebrates and whether they prefer closed scrub over the open grasslands.

The St Helena's endemic wirebird will most likely benefit from grazing and clearance of wild mango as it can utilise short pastures thus created as feeding habitats and possibly even for breeding. Habitat preferences of the native moorhen need to be looked at in more detail. Moorhens probably prefer thick closed vegetation for breeding and feeding but they have also been seen on the grazed pasturelands.

Disturbed areas adjacent to Cook's Bridge could be used in experimenting with native wetland vegetation, including a small (5 plants) experiment with large jellico (*Berula bracteata*) in the water channel. *Probably native* species like thatching rush, proliferous spike-rush and both of the two beard-grass species can be used in re-vegetating the wet areas. It is also suggested that endemic shrubs ebony (*Trochetiopsis ebenus*) and rosemary (*Phylica polifolia*) will be experimented as foundations for endemic riparian shrubland. Gumwood (*Commidendrum robustum*) is not suggested in this area as there are plans to plant closely related scrubwood (*Commidendrum rugosum*) close by and there is a risk of hybridization of these two species. It is how ever recognized that gumwood probably had an important role in the riparian vegetation at least on the edges of the wet valley bottoms.

It is suggested that outlying wild mango pockets growing in the thatching grass at the lower end of the survey area will be completely taken out and either trialled with endemic planting or let for thatching grass to take over the sites. This is to stop the wild mango from spreading further down the valley.

6.2.1Planting trials downstream from Cook's Bridge

It is suggested that downstream from Cook's Bridge experimental plantings would take place to study how to gradually develop the wild mango thickets and thatching grass sward into native wetland vegetation and riparian woodland. Small scale clearance of wild mango could take place and endemic ebony and rosemary planted on the sites. Trials of planting ebony and rosemary directly into the thatching grass could also take place. Grass could in theory protect the seedlings from rabbit grazing and may also give some level of protection from the effects of heavy flood waters. It would be very interesting to see if the trees and shrubs could eventually overgrow the thatching grass and overshadow it in the same way that wild mango currently does. Thatching grass is potentially a strong competitor for water and nutrients, but in a wetland like Fisher's Valley this shouldn't be a problem at least in winter time when there is plenty of water available. These small experiments would give valuable information on the possibilities of wetland restoration particularly in Fisher's Valley and also more widely on St Helena.

6.3 Erosion control

It is suggested that thatching rush and samphire are planted in the mouth of the gully that flows to Fisher's Valley from Bradley's side on the eastern side of Cook's Bridge. These species will hopefully bind the material coming down from the eroded hillsides and stop it from moving downstream.

7. References

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Appendix 1. Survey points and records in Domin scale

Table 1. General information on the sample plots. GPS records in WGS 84, UTM UPS.

Sample no.	v	Y	Data	Altitudo	Sample area	Stand area	Slope	Arnort	Mean height, trees (m)	Mean height: shrubs (m)	Mean height: Herbaceous (cm)	1ean height: ground cover (mm)	Cover: trees	Cover: shrubs	Cover: herbaceous	Cover: ground cover	Coology
1	^ 0215048	8234325	21.10.2014	317	10 x 10 m		0 Sibpe	-			3	2			99		Alluvial silt
2	0215035	8234295	21.10.2014	317	20 x 5 m	40 x 5 m					30				90		Alluvial silt
3	0215015	8234292	21.10.2014	319	10 x 10 m				5				75				Alluvial silt
4	0214996	8234296	21.10.2014	322	20 x 5 m						3				25		Alluvial silt
5	0215025	8234282	21.10.2014	322	1 x 100 m	1 x 100 m					20				75		Alluvial silt
6			21.10.2014		10 x 10 m												Alluvial silt
_																	Basaltic
7	0215841	8234422	22.10.2014	264	5 x 5 m	5 x 5 m		120			30				50		rock
8	0215797	8234410	22.10.2014	268	10 x 10 m						90				100		Alluvial silt
9	0215649	8234414	22.10.2014	279	5 x 20 m						90				100		Alluvial silt
10	0215625	8234411	22.10.2014	274	10 x 10 m	30 x 10 m					20				75		Alluvial silt
11	0215497	8234410	22.10.2014	289	10 x 10 m				5				75			25	Alluvial silt
12	0215300	8234414	22.10.2014	305	10 x 10 m	30 x 10 m	30	110			5	10			60		Basaltic rock
13	0215188	8234423	22.10.2014	311	10 x 10 m						10				60		Eroded silt



Map 6 -Numbered sample plots in the survey area and how they relate to different stands of homogenous vegetation.

Table 2. Plant records in all the survey plots, abundances are recorded in Domin scale (See table 1. in the main document). Numbers in the header row refer to sample plots (X is for the endemic species found outside the actual survey area).

Family	Scientific name	Status	Local name	1	2	3	4	5	6	7	8	9	10	11	12	13	X
Aizoaceae	Carpobrotus edulis	Naturalised	creeper						11	5					2	8	
Aizoaceae	Mesembryanthemum crystallinum	Possibly native	ice plant				1										
Aizoaceae	Tetragonia tetragonoides	Naturalised	New Zealand spinach				11										
Anacardiaceae	Schinus terebinthifolius	Naturalised	wild mango	2		8			11	4	11	11		8		11	
Apiaceae	Apium graveolens	Naturalised	celery							4							
Asteraceae	Ageratum conyzoides	Naturalised	blueweed						11								
Asteraceae	Chrysanthemoides monilifera	Naturalised	wild coffee													11	
Asteraceae	Conyza bonariensis	Naturalised	fleabane														
Asteraceae	Osteospermum sanctae-helenae	Endemic															11
Asteraceae	Sonchus oleraceus	Naturalised	smooth sow-thistle							2							
Chenopodiaceae	Atriplex nummularia	Naturalised	old man saltbush				11										
Chenopodiaceae	Atriplex semibaccata	Naturalised	saltbush			11	5			1				11		4	
Chenopodiaceae	Chenopodium murale	Naturalised	common goosefoot				1										
Commelinaceae	Commelina diffusa	Naturalised	tallow-vine									11	8				
Cupressaceae	Cupressus sp.	Forestry species	cupress			11											
Cyperaceae	Bulbostylis lichtensteiniana	Endemic	tufted sedge												4		
Cyperaceae	Cyperus polystachyos	Possibly native	field sedge		3			4	11				2				
Cyperaceae	Ficinia nodosa	Probably native	thatching rush							5	11						
Cyperaceae	Isolepis prolifer	Probably native	proliferous spike-rush		4			9	11	5				11			
Ebenaceae	Diospyros	Naturalised	poison peach											11	1	11	

	dichrophylla															
Fabaceae	Acacia cyclops	Naturalised	red-eye acacia												11	
Frankeniaceae	Frankenia portulacifolia	Endemic	St Helena tea plant													11
Myrtaceae	Eucalyptus resinifera	Forestry species	red mahogany gum			11							11			
Poaceae	Echinochloa pyramidalis	Naturalised	bamboo grass		10			4				10				
Poaceae	Pennisetum clandestinum	Naturalised	kikuyu grass	10	4	11	2									
Poaceae	Pennisetum macrourum	Naturalised	thatching grass		11				11		10	11	11			
Poaceae	Pennisetum purpureum	Naturalised	elephant grass		11											
Poaceae	Polypogon monspeliensis	Probably native	annual beard-grass						11							
Poaceae	Polypogon tenuis	Probably native	Cape beard-grass							2						
Poaceae	Sporobolus africanus	Naturalised	Cape grass							1				4		
Poaceae	Stenotaphrum secundatum	Naturalised	mat grass										11			
Poaceae	Tribolium obliterum	Native	bayonet grass							2			11	2		
Poaceae	Vulpia bromoides	Naturalised	squirrel's-tail fesque											6		
Solanaceae	Solanum nigrum	Naturalised	diddly dight	3	2			3	11				11			
Verbenaceae	Lantana camara	Naturalised	lantana											3		